Short-term CO_2 treatment of harvested grapes (*Vitis vinifera* L., cv. Trebbiano) before partial dehydration affects berry secondary metabolism and the aromatic profile of the resulting wine

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Table S1 - Carotenoids, chlorophylls e xanthophylls in Trebbiano grape skin during postharvest storage inside the dehydration chamber

	T0	T1		T2	
		Control	Treated	Control	Treated
Beta-carotene	1.91 ± 0.16 a	**1.28 ± 0.05 b**	**2.293 ± 0.09 a**	1.02 ± 0.02 b	1.285 ± 0.098 b
Lutein	0.51 ± 0.14 a	0.67 ± 0.39 a	0.69 ± 0.05 a	0.49 ± 0.006 a	0.48 ± 0.01 a
Zeaxanthin	0.42 ± 0.024 a	0.065 ± 0.037 b	0.076 ± 0.0098 b	0.058 ± 0.0075 b	0.054 ± 0.02 b
Neoxanthin	0.14 ± 0.054 a	0.037 ± 0.009 b	0.045 ± 0.0037 b	0.03 ± 0.0028 b	0.028 ± 0.0023 b
Violaxanthin	0.15 ± 0.02 a	**0.078 ± 0.013 b**	**0.153 ± 0.019 a**	0.069 ± 0.0094 b	0.036 ± 0.0306 b
Anteraxanthin	0.24 ± 0.015 a	0.017 ± 0.0065 b	0.013 ± 0.014 b	0.022 ± 0.0078 b	0.0056 ± 0.0055 b
Chlorophyll a	8.06 ± 0.59 ab	**5.747 ± 0.136 bc**	**9.813 ± 0.086 a**	3.806 ± 0.131 c	5.678 ± 0.294 c
Chlorophyll b	1.74 ± 0.13 ab	**1.23 ± 0.02 c**	**2.09 ± 0.14 a**	**0.79 ± 0.05 d**	**1.34 ± 0.07 c**

Table S1 - Carotenoids, chlorophylls and xanthophylls content (μg/g fresh weight) in Trebbiano berry skin of control and treated berries allowed to wither inside a dehydration chamber, at harvest time (T0), at 30% weight loss (T1), and at the end of the drying period (T2) when berries lost about 50% of weight. Treated berries were incubated for 24 h with CO_2 (30%, 14° C), and then allowed to wither at this temperature, while control berries were not subjected to the treatment and allowed to wither at the same environmental parameters. Statistically significant differences were evaluated by one-way ANOVA ($p \leq 0.05$), and different letters indicate significantly different values according to Tukey–Kramer test.

Table S2 - Phenolic classes in Trebbiano grape skin (2008) during post-harvest storage inside the dehydration chamber

	T0	T1		T2	
		Control	Treated	Control	Treated
Total phenols (mg GAE/g d.w.)	9.99±0.	14.47±1.84 a	11.33±0.64 ab	9.9±2.63 b	7.99±0.516 b
Flavonoids (mg CTCE/g d.w.)	6.99±0.	**11.56±0.17 a**	**8.64±0.47 b**	**5.89±0.43 c**	**3.71±1.076 d**
Flavonols (mg QCTE/g d.w.)	0.56±0.	0.83±0.049 a	0.64±0.005 ab	0.22±0.07 c	0.41±0.069 bc
Proanthocyanidins (mg CYAE/g d.w.)	0.99±0.	1.74±0.17 a	1.51±0.11 a	1.18±0.075 ab	0.70±0.12 b
Flavan-3-ols (mg CTCE/g d.w.)	3.87±0.	5.45±0.044 a	4.19±0.37 a	2.69±0.13 ab	1.56±0.37 b
Tartaric acid esters (mg CAE/g d.w.)	0.51±0.	0.92±0.1 a	0.61±0.067 a	0.32±0.0024 a	0.40±0.082 a

Table S2 - Phenol content in Trebbiano berry skin of control and treated berries allowed to wither inside a dehydration chamber, at harvest time (T0), at 30% weight loss (T1), and at the end of the drying period (T2) when berries lost about 50% of weight. Treated berries were incubated for 24 h with CO_2 (30%, 14° C), and then allowed to wither at this temperature, while control berries were not subjected to the treatment and allowed to wither at the same environmental parameters. Statistically significant differences were evaluated by one-way ANOVA ($p \leq 0.05$) and different letters indicate significantly different values according to Tukey–Kramer test. GAE: gallic acid equivalents; CTCE: catechin equivalents; QCTE: quercetin equivalents; CYAE: cyanidin equivalents; CAE: caffeic acid equivalents; d.w.: dry weight.

Table - S3 Free aroma compounds in Trebbiano wine (µg/L)					
Aromatic families		**Control**	**Treated**	**Odor threshold (µg/L)**	**Reference**
Acids	**Propanoic acid**	176.57 ± 28.5	192.65 ± 58.5	20000	[1]
	Isovaleric acid + 2-methylbutyric acid	554.72 ± 1.3	717.91 ± 127.1	700*	[1]
	Hexanoic acid (caproic acid)	1223.52 ± 61.3	1132.02 ± 41.1	1000-10000, 8800	[1,2]
	Octanoic acid (caprylic acid)	1167.00 ± 517.7	977.33 ± 153.9	15000	[1]
	Decanoic acid (capric acid)	**963.99 ± 102.5 a**	**72.97 ± 10.2 b**	8200	[1]
	Hexadecanoic acid (palmitic acid)	**552.43 ± 76.4**	**n.d.**	-	
	Isobutyric acid	401.73 ± 290.7	694.01 ± 79.5	8100	[1]
Dioxanes and dioxolanes	**N-ethylacetamide**	118.74 ± 8.9	198.61 ± 117.5	-	
Alcohols	**1-propanol**	7183.62 ± 796.3	5784.30 ± 2010.5	-	
	Isobutanol	7950.99 ± 4625.4	8893.60 ± 1349.8	75000 40000	[2,3]
	1-butanol	377.03 ± 98.8	309.00 ± 50.2	40000	[4]
	Isoamylic alcohol	75094.42 ± 53935.9	87152.11 ± 3223.0	7000	[1]
	3-methyl-1-pentanol	105.20 ± 23.0	74.50 ± 30.4	-	
	3-ethoxy-1-propanol	1320.42 ± 311.4	1998.30 ± 348.3	-	
	2,3-butanediol	**3318.60 ± 514.6 b**	**32459.2 ± 2956.9 a**	40000	[5]
	1,2-propanediol	**444.28 ± 163.3 b**	**1207.75 ± 507.3 a**	-	
	2-furanmethanol	1791.57 ± 212.1	1534.49 ± 208.9	-	
	2-phenylethanol	17433.69 ± 3063.0	20937.82 ± 426.8	7500	[1]
	Glycerol	533.43 ± 202.7	677.20 ± 180.2	-	
	Tyrosol	1505.55 ± 724.8	2406.2 ± 303.3	-	
Esters	**Isoamyl acetate**	316.48 ± 92.6	308.80 ± 10.2	200	[1]
	Ethyl hexanoate	437.40 ± 62.2	415.20 ± 293.6	65, 14, 5	[3,6,7]
	Ethyl lactate	256.46± 50.7	236.50 ± 32.8	14000	[1]
	Acetic acid+ethyl octanoate	23608.34 ± 12429.6	24100.30 ± 11186.6	250**	[1]
	Ethyl-3-hydroxy butyrate	103.00 ± 72.8	313.57 ± 163.1	-	
	Diethyl succinate	**374.60 ± 2.3 b**	**463.42 ± 36.2 a**	100000	[5]
	Ethyl-9-decanoate	**27.70 ± 19.6**	**n. d.**	200	[6]
	1,3 propanediol monoacetate	**459.82 ± 43.2 b**	**894.12 ± 315.4 a**	-	
	Ethyl 4-hydroxybutanoate	13458.93 ± 1015.5	17427.80 ± 4017.1	-	
	Ethyl decanoate	**341.71 ± 81.0 a**	**171.58 ± 58.3 b**	200	[6]
	Diethyl malate	**58.40 ± 41.3**	**n. d.**	760000	[5]
	4-hydroxy-isopenthyl butanoate	185.59 ± 26.5	260.68 ± 65.4	-	
	Ethyl c16	**988.82 ± 601.7 a**	**134.40 ± 95.0 b**	-	
	Ethyl-γ-hexadecanoate	**178.39 ± 89.3 a**	**42.20 ± 29.8 b**	-	
	Mono ethyl succinate	5010.88 ± 1302.1	4150.00 ± 1792.5	1000000	[5]
	Ethyl c18	**334.58 ± 37.4**	**n. d.**	-	
	Ethyl oleate	**303.17 ± 24.4**	**n. d.**	-	
	Ethyl linoleate	**218.77 ± 178.7**	**n. d.**	-	
Volatile phenols	**4-vinyl guaiacol**	126.03 ± 8.2	217.14 ± 127.9	10, 40	[7,8]
	Vanillin	**16.88 ± 3.9**	**n. d.**	200	[3]
	Methyl vanillate	**4.36 ± 2.2**	**n. d.**	-	
	Ethyl vanillate	**53.75 ± 6.0**	**n. d.**	-	
	Acetovanillone	**150.35 ± 43.0**	**n. d.**	-	
	Zingerone (vanillylacetone)	**13.79 ± 9.5**	**n. d.**	-	
	Guaiacyl propanol	**351.64 ± 164.7**	**n. d.**	-	
	Guaiacyl ethanol	**295.35 ± 213.2**	**n. d.**	-	
Other molecules	**Acetoin**	1694.85 ± 618.2	2029.29 ± 1036.1	150000	[7]
	1-hexanal	529.87 ± 90.9	486.72 ± 3.2	5	[9]
	Furfural	2331.91 ± 490.6	1308.34 ± 543.8	770	[5]
	γ-butyrolactone + acid c4	**1663.11 ± 148.6 a**	**1201.35 ± 217.0 b**	1000***	[5]
	Methionol	**75.73 ± 9.3 a**	**25.48 ± 36.0 b**	1000	[7]
	2-hydroxy-4-piranone	249.50 ± 57.7	1021.1 ± 932.9	-	
	Pentalactone	**24.43 ± 4.5**	**n. d.**	-	
	4-carbethoxy-γ-butyrolactone precursor	**62.34 ± 21.6 a**	**24.81 ± 5.1 b**	-	
	4-carbethoxy-γ-butyrolactone	18.17 ± 11.7	6.95 ± 2.8	-	
26.30 ± 7.2	**3-oxo-α-ionol**	**26.30 ± 7.2**	**n. d.**	-	

* The threshold value is referred only to isovaleric acid.
**The threshold value is referred only to ethyl octanoate.
***The threshold value is referred only to γ-butyrolactone.

Table S3 - Free aroma compound content in Trebbiano wine (µg/L) obtained from totally air-stored berries (control) and CO_2-treated berries (treated), together with the odor threshold values (µg/L) found in the literature. Control and treated berries were allowed to wither inside a dehydration chamber. Treated berries were incubated for 24 h with CO_2 (30%, 14° C), and then allowed to wither at this temperature, while control berries were not subjected to the treatment and allowed to wither at the same environmental parameters. Different letters indicate statistically significant differences according to t-test ($p \leq 0.05$). Means not followed by any letters are not statistically different (t-test, $p \leq 0.05$).

Table S4 - Glycosylated bound aroma compounds in Trebbiano wine (µg/L)					
Aromatic families		**Control**	**Treated**	**Odor threshold (µg/L)**	**Reference**
Alcohols	**Hexanol**	**5.40 ± 3.0 b**	**13.19 ± 2.3 a**	2500	[5]
	Octanol	11.76 ± 1.9	11.41 ± 1.5	-	
	Myrtenol	2.11 ± 0.3	2.31 ± 0.2	-	
	2-(2-butoxyethoxy)-ethanol	6.88 ± 0.7	7.94 ± 1.1	-	
	Benzyl alcohol	8.82 ± 0.1	8.67 ± 0.2	-	
	2-phenyl ethanol	10.84 ± 0.8	10.72 ± 0.6	-	
Volatile phenols	**Eugenol**	1.71 ± 0.1	2.04 ± 0.3	6, 5	[3,7]
	Methyl vanillate	7.48 ± 1.1	6.60 ± 1.2	-	
	Acetovanillone	7.77 ± 0.7	8.40 ± 1.3	-	
	Zingerone (vanillylacetone)	12.88 ± 1.5	15.43 ± 2.6	-	
Terpenes	**linalool oxide furanoid (LOF) CIS**	**n. d.**	**0.47 ± 0.1**	6000	[5]
	LOF TRANS	**n. d.**	**0.63 ± 0.2**	6000	[5]
	Linalool	**3.02 ± 1.4 b**	**6.40 ± 0.4 a**	50	[5]
	α-terpineol	**7.04 ± 0.8 b**	**12.50 ± 1.3 a**	250	[7]
	LOP (linalool oxide pyranic) TRANS	0.69 ± 0.3	0.73 ± 1.0	-	
	LOP CIS+ methyl salicylate	1.09 ± 0.4	1.40 ± 0.6	-	
	3,7-diol	1.03 ± 0.2	1.00 ± 0.0	-	
	***p*-cymen-α-ol**	3.06 ± 0.2	3.57 ± 0.9	-	
	***p*-1-menthen-7,8-diol**	10.02 ± 0.6	9.82 ± 0.1	-	
	Citronellol	5.69 ± 0.9	8.10 ± 0.6	100	[3]
	Nerol	28.90 ± 0.8	27.20 ± 1.5	60	[10]
	Geraniol	148.10 ± 15.6	171.95 ± 35.0	30	[3]
	Exo-2-hydroxycineole	10.84 ± 1.0	10.81 ± 1.5	-	
	Linalool hydrate	0.92 ± 0.1	1.03 ± 0.3	-	
	Citronellol hydrate	**17.37 ± 0.5 b**	**24.40 ± 2.7 a**	-	
	3,8-diol + nerol hydrate	**n. d.**	**7.60 ± 0.9**	-	
	(Z)-8-hydroxylinalool + geraniol hydrate	**14.93 ± 0.0 b**	**21.02 ± 1.3 a**	-	
Esters	**Ethyl caprate**	0.94 ± 0.1	1.20 ± 0.3	-	
	Isopropyl myristate	9.91 ± 1.1	9.80 ± 1.9	-	
C13	**3,4-dihydro-3-oxo-actinidol I (ACTI I)**	4.37 ± 0.3	5.65 ± 1.0	-	
	ACTI II	5.52 ± 0.5	5.60 ± 1.0	-	
	ACTI III	6.92 ± 0.3	7.68 ± 1.0	-	
	ACTI IIII + 3 hydroxy-β-damascone	53.71 ± 0.5	56.48 ± 10.2	-	
	3-hydroxy-7,8-dihydro-β-ionone	9.90 ± 0.5	11.31 ± 1.9		
	3-oxo-α-ionol + 4-oxo-β-ionol	118.64 ± 7.8	133.29 ± 24.9	-	
	3-hydroxy-7,8-dihydro-β-ionol	**55.30 ± 6.1 b**	**100,20 ± 11.7 a**	-	
	4-oxo-7,8-dihydro-β-ionol + hydroxy-β-ionone	20.76 ± 2.6	19.51 ± 3.0	-	
	3-oxo-7,8-dihydro-α-ionol	**6.72 ± 0.3 b**	**9.35 ± 1.6 a**	-	
	3-oxo-retro-α-ionol	6.10 ± 0.5	6.66 ± 0.3	-	
	7,8-dihydrovomifoliol	23.69 ± 3.4	18.73 ± 5.8	-	
	Vomifoliol	4.90 ± 1.2	4.15 ± 2.1	-	

Table S4 - Glycosilated-bound aroma compound content in Trebbiano wine (µg/L) obtained from totally air-stored berries (control) and CO_2-treated berries (treated), together with the odor threshold values (µg/L) found in the literature. Control and treated berries were allowed to wither inside a dehydration chamber. Treated berries were incubated for 24 h with CO_2 (30%, 14° C), and then allowed to wither at this temperature, while control berries were not subjected to the treatment and allowed to wither at the same environmental parameters. Different letters indicate statistically significant differences according to t-test ($p \leq 0.05$). Means not followed by any letters are not statistically different (t-test, $p \leq 0.05$).